

Factors associated with the development of pressure injuries in elective surgery: integrative review

Fatores associados ao desenvolvimento de lesões por pressão em cirurgia eletiva: revisão integrativa

Factores asociados al desarrollo de lesiones por presión en cirugía electiva: revisión integrativa

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ABSTRACT: Objective: To identify factors associated with the development of pressure injuries (PI) in the perioperative period in individuals undergoing elective surgery. Method: Integrative literature review carried out in 2021 with the help of *Biblioteca Virtual em Saúde* (BVS). Results: 135 articles were identified in the database, of which 19 were selected for extraction of results. The inclusion criteria of the articles were: being original, answering the research question, published in Portuguese, English or Spanish, presenting as a population: surgical patients; as exposure: preoperative, intraoperative or postoperative risk factors; and as a result: LP development. Of the articles included, 15.8% were carried out in Brazil, with a predominance of the level of evidence LE=2 (n = 15; 68.2%). Conclusion: Intrinsic and extrinsic factors related to surgery, medications in use, comorbidities, pre-surgical clinical status, sex, age, being admitted from a place other than their residence, open surgeries, type of surgery were associated with the development of injury, type of anesthesia, hypotensive episodes, transfusion, surgical time, use of cushion, skin conditions, increased intraoperative pressure, skin temperature, hypothermia.

Keywords: General surgery. Perioperative nursing. Specialties, surgical. Risk factors. Pressure ulcer.

RESUMO: Objetivo: Identificar os fatores associados ao desenvolvimento de lesão por pressão (LP) no período perioperatório em indivíduos submetidos a cirurgia eletiva. Método: Revisão integrativa da literatura realizada, em 2021, com o auxílio da Biblioteca Virtual em Saúde (BVS). Resultados: Identificaram-se 135 artigos na base de dados, dos quais 19 foram selecionados para extração dos resultados. Os critérios de inclusão dos artigos foram: serem originais, responderem à pergunta de pesquisa, publicados em português, inglês ou espanhol, apresentarem como população: pacientes cirúrgicos; como exposição: fatores de risco no pré-operatório, intraoperatório ou pós-operatório; e como resultado: desenvolvimento de LP. Dos artigos incluídos, 15,8% foram realizados no Brasil, com predominância do nível de evidência NE=2 (n = 15; 68,2%). Conclusão: Associam-se ao desenvolvimento de lesão fatores intrínsecos e extrínsecos relacionados com cirurgia, medicamentos em uso, comorbidades, estado clínico pré-cirúrgico, sexo, idade, ser admitido de um outro local que não sua residência, cirurgias abertas, tipo de cirurgia, tipo de anestesia, episódios hipotensivos, transfusão, tempo cirúrgico, uso de coxim, condições da pele, aumento da pressão no intraoperatório, temperatura da pele, hipotermia.

Palavras-chave: Cirurgia geral. Enfermagem perioperatória. Especialidades cirúrgicas. Fatores de risco. Lesão por pressão.

RESUMEN: Objetivo: Identificar factores asociados al desarrollo de lesiones por presión (LP) en el perioperatorio en sujetos sometidos a cirugía electiva. Método: Revisión integrativa de la literatura realizada en la Biblioteca Virtual en Salud (BVS) en 2021. Resultados: 135 artículos fueron identificados en la base de datos y 19 fueron seleccionados para la extracción de resultados. Los criterios de inclusión de los artículos fueron: ser originales, responder a la pregunta de investigación, publicados en portugués, inglés o español, con la siguiente población: pacientes quirúrgicos; como exposición: factores de riesgo preoperatorios, intraoperatorios o postoperatorios; y como resultado: desarrollo de LP. De los artículos incluidos, 15,8% fueron realizados en Brasil con predominio del nivel de evidencia NE=2 (n = 15; 68,2%). Conclusión: Asociados con el desarrollo de lesiones, están: Factores intrínsecos y extrínsecos relacionados con la cirugía, medicamentos en uso, comorbilidades, estado clínico prequirúrgico, sexo, edad, ser ingresado de lugar diferente al de residencia, cirugías abiertas, tipo de cirugía, tipo de anestesia, episodios de hipotensión, transfusión, tiempo quirúrgico, uso de almohadillas, afecciones de la piel, aumento de la presión intraoperatoria, temperatura de la piel, hipotermia.

Palabras clave: Cirugía general. Enfermería perioperatoria. Especialidades quirúrgicas. Factores de riesgo. Úlcera por presión.

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Received: 12/22/2021 – Approved: 06/27/2022

<https://doi.org/10.5327/Z1414-4425202227779>

INTRODUCTION

Pressure injury (PI) can be defined as localized damage to the skin and/or underlying soft tissues, usually over a bony prominence, as a result of intense and/or prolonged pressure or pressure with shear¹. In the global scenario, a recent study identified an incidence of PI in hospitalized patients of 8.5%²; while another had an incidence of PI in surgical patients of 4.7%³ and a prevalence of 30.6%⁴. In Brazil, the incidence in individuals varies from 6.4 to 49.2%⁵⁻⁹.

With regard to surgical patients, it is necessary to consider that, during the intraoperative period, they are immobilized, positioned on a relatively hard surface, unable to feel the pain caused by pressure and shear forces, in addition to the inability to change their position to relieve pressure when under the effect of anesthetic agents¹⁰. In this context, it is noteworthy that around 50% of patients undergoing elective surgery are at high risk of developing PI in the perioperative period¹¹.

It is noteworthy that PIs can be considered an indicator of the quality of health care provided¹² and perioperative nurses play an important role in the results on patient safety¹³. In addition, the cost of treating these injuries is high¹⁴ and can lead to an overload on the nursing team⁷. Given the above, the National Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária – ANVISA*) published a technical note that discusses the prevention of PI in health services.

In this sense, one should invest in the prevention of these injuries, and the production of evidence about the factors associated with the development of PI resulting from surgical positioning can contribute to the understanding of this complex problem. In addition, this study may provide support for the implementation of nursing interventions with the purpose of reducing the risk of developing these lesions in the perioperative period.

Although there are already systematic reviews on risk factors in relation to the development of PI, these were performed with specific types of surgeries, such as cardiovascular, general, lower limb amputation and cardiac. Hence the need to perform an integrative review with elective surgeries.

OBJECTIVE

To identify factors associated with the development of PI in the perioperative period in individuals undergoing elective surgery.

METHOD

The study is an integrative literature review built from five steps:

1. Identifying the problem;
2. Literature search;
3. Data evaluation;
4. Data analysis;
5. Presentation¹⁵.

Step 1: the elaboration of the research question was carried out based on the PICo strategy (Population, Interest, Context), and the following review question was formulated: “What are the factors associated with the development of PI in the perioperative period in individuals undergoing elective surgery?”. In which P refers to individuals undergoing elective surgery, I to factors associated with the development of PI and Co in the perioperative period.

Step 2: the terms used in the search were extracted from the Descriptors in Health Sciences (DeCS), including: Risk factors, Pressure injury, Surgery, in addition to their synonyms. The search for productions was carried out in: Latin American and Caribbean Literature in Health Sciences (LILACS), Medical Literature Analysis and Retrieval System Online (Medline) and Nursing Database (BDENF), via *Biblioteca Virtual em Saúde* (BVS), in February 2021, using the following search strategy: (mh:(“risk factors”)) AND (mh:(“pressure injury”)) AND (tw:(“surgery” OR “surgeries” OR “operations”)), with 135 results.

Step 3: Inclusion criteria for articles were — original articles that answered the research question, published in Portuguese, English or Spanish. During the evaluation of the productions, some duplicates were found, which were analyzed only once.

To access the full text, tools from BVS itself, Google searches and contact via email with the authors were used. The article selection process was carried out by two reviewers, independently. Differences were analyzed by a third reviewer. After the selection process, 19 articles were included, as shown in Figure 1.

Step 4: after selecting the articles, data analysis was performed. Therefore, an evidence synthesis instrument was developed in a Microsoft Office Excel® spreadsheet by the authors. This instrument contains the following data: reference, year of study, country of study, type of study, data

referring to the sample and surgical specialty, in addition to factors associated with the development of PI. This information can be viewed in Chart 1.

The quality of the literature included in this review was not prioritized, but its level of evidence (LE) was assessed, according to the primary research objective¹⁶. As all the articles included were aimed at the etiology, only this classification of evidence was used. This information is contained in Chart 2.

LE 1 was considered: synthesis of cohort or case-control studies; LE 2: cohort study or case control; LE 3: metasynthesis or synthesis of descriptive studies; EL 4: descriptive or qualitative study; EL 5: expert opinion¹⁶.

Step 5: to evaluate the characteristics of the studies, a simple descriptive statistical analysis was performed, presenting absolute and relative frequency. Furthermore, a synthesis of the evidence found was carried out.

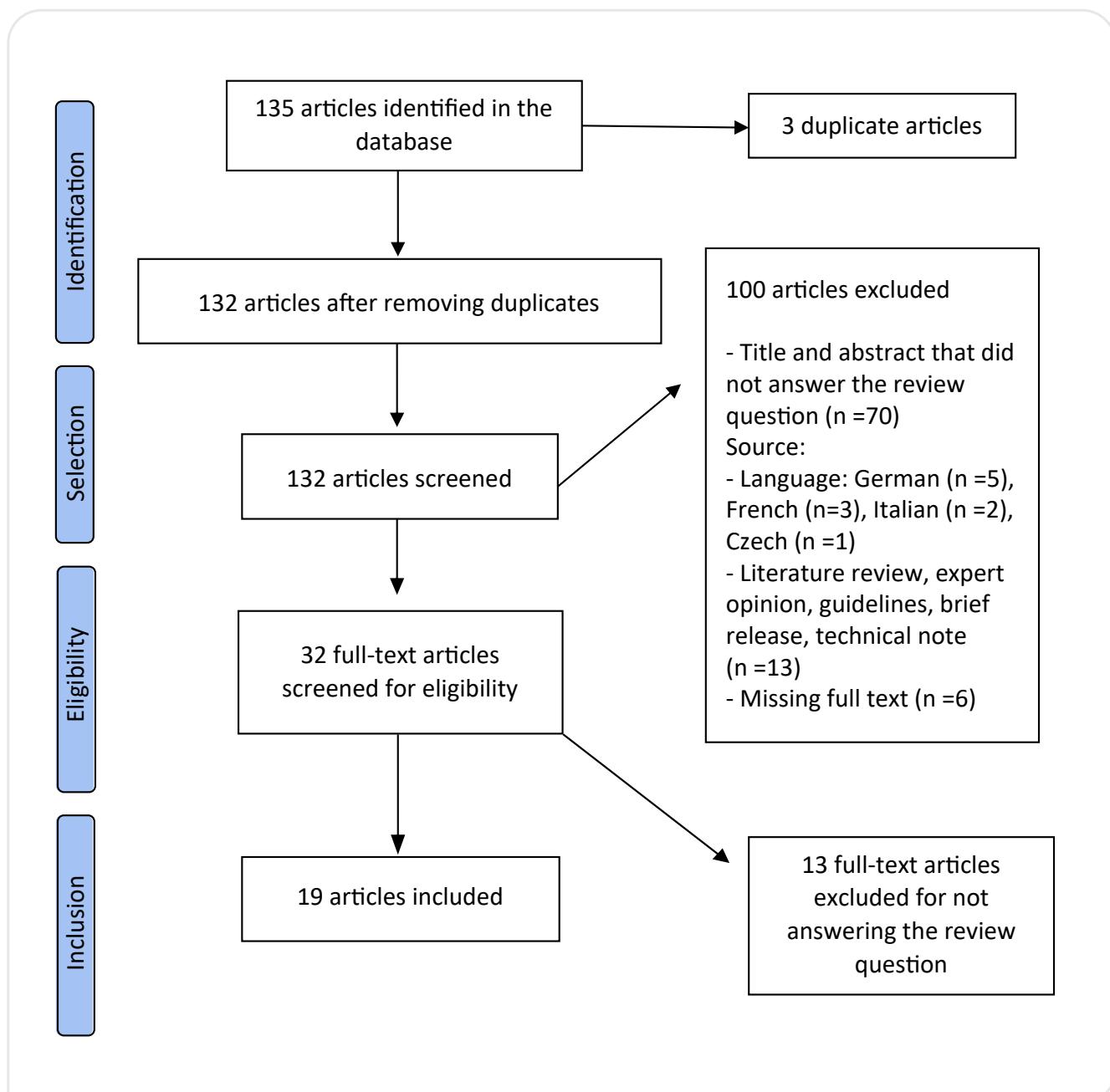


Figure 1. Flowchart of identification, selection and inclusion of studies, prepared based on PRISMA recommendations.

Chart 1. Sample, mean age, type of surgery and summary of factors associated with pressure injury development of the included studies.

Cod.*	Sample	Mean age or age range	Type of surgery	Factors associated with the development of PI
A1 ¹⁷	n = 803	59 years	Hepatobiliary gastrointestinal surgery	- Pancreatoduodenectomy, - Open surgery, - Surgical time greater than 197 minutes, - Intraoperative hypotensive episodes.
A2 ¹⁸	n = 29	44.4 years	Neurosurgery	- Increase in skin temperature.
A3 ¹⁹	n = 286	46.9 years	Cardiovascular surgery	- Perioperative administration of corticosteroids.
A4 ²⁰	n = 32,963	58 years	Cardiac, general, hepatobiliary, neurological, oncological, plastic, thoracic, transplant, trauma, urological and vascular surgery	- Surgery time.
A5 ²¹	n = 534	54.1 years	General and orthopedic surgery	- Reduced turgor or edema, - Being admitted from a place other than one's residence, - Advanced age.
A6 ²²	n = 88	61.84 years	Head and neck surgery	- Decreased age, - Surgery time.
A7 ²³	n = 2,695	60 years (without PI) and 63 years (with PI)	Surgery of patients in burn ICU, surgical ICU, and cardiovascular ICU	- Intraoperative transfusion of blood products.
A8 ²⁴	n = 102	62.3 years	Cardiac, neurological, plastic, vascular and general surgery	- <i>Diabetes mellitus</i> , - Heart diseases, - Time on the operating table greater than 6.15 hours, - Intraoperative hypothermia.
A9 ²⁵	n = 199	52.6 years	Orthopedic, neurological and gastrointestinal surgery	- Prone position, - General anesthesia, - Sheet cushion, - Surgery time.
A10 ²⁶	n = 258	46 to 75 years	General, neurological, orthopedic, and other surgeries lasting three hours or more	- <i>Diabetes mellitus</i> , - Age ≥ 70 years, - Low score on the Braden scale in the immediate postoperative period.
A11 ²⁷	n = 100	63.5 (men) and 65.8 (women)	Cardiac surgery	The variables evaluated in the study did not show statistical significance with the development of PI.
A12 ²⁸	n = 34	74.3 years	Hip or knee replacement surgery	- Knee replacement surgery (heels do not float during surgery), - Type of anesthesia: peripheral nerve block.
A13 ²⁹	n = 286	67.1 years	Orthopedic, cardiac, abdominal, elective and emergency surgery	- Women, - High ASA surgical risk score, - High NYHA heart failure classification score, - Nutritional status.
A14 ³⁰	n = 208	61 years	Cardiac, neurological, head and neck oncology, vascular, orthopedic, oncology, gastroenterology, plastic and urology surgery	- Surgery time over 4 hours.

Continue...

Chart 1. Continuation.

Cod.*	Sample	Mean age or age range	Type of surgery	Factors associated with the development of PI
A15 ³¹	n = 163	64.5 years	Cardiac and vascular surgery	- Low hemoglobin concentration on admission, - Low score on the Braden scale in the postoperative period, - Use of corticosteroids in the postoperative period.
A16 ³²	n = 45	50.9 years	Elective surgery	- Age ≥ 46, - Systemic arterial hypertension.
A17 ³³	n = 5,136	57.76 years	Digestive tract surgery	- Preoperative skin change (erythema, ecchymosis, blister, lesions), - Reduction of preoperative physical mobility, - Surgical positioning, - Increased intraoperative pressure.
A18 ³⁴	n = 269	63 years	Elective surgery	- Age ≥ 75 years, - Women, - ASA surgical risk score ≥ 3, - BMI < 23, - Low score on the Braden scale in the preoperative period, - Anemia, respiratory diseases, and hypertension.
A19 ³⁵	n = 278	48.7 years	Elective surgery	- Women, - Advanced age, - Altered BMI.

*Cod: encoding; PI: pressure injury; ASA: American Society of Anesthesiologists; NYHA: New York Heart Association; BMI: body mass index. Several factors associated with the development of pressure injuries in individuals undergoing elective surgery were identified, which are explained in Chart 2 3.

Chart 2. Factors associated with the development of pressure injuries divided by levels of evidence.

	LE 2	LE 4
Factors associated with the development of PI in individuals undergoing elective surgeries	<i>Diabetes mellitus</i> ^{24,26} Prolonged surgery time ^{20,22,25,30} Women ^{34,35} Advanced age ^{21,26,32,35} Systemic arterial hypertension ^{32,34} Heart diseases ²⁴ Altered body mass index ³⁵ Nutritional status ²⁹ Being admitted from a place other than one's residence ²¹ Low hemoglobin concentration on admission ³¹ Reduction of preoperative physical mobility ³³ Open surgeries ²⁷ Type of surgery: pancreateoduodenectomy ²⁷ or knee replacement surgery ²⁸ Surgical positioning ³³ Peripheral nerve block ²⁸ Intraoperative hypotensive episodes ¹⁷ Time on the operating table ²⁴ High surgical risk score from the American Society of Anesthesiologists ^{29,34} or high score from the New York Heart Association classification of heart failure ²⁹ Skin conditions such as reduced turgor, edema ²¹ , erythema, ecchymosis, blister, and lesions ³³ Increased intraoperative pressure ³³ Increase in skin temperature ¹⁸ Intraoperative hypothermia ²⁴ Low score on the Braden scale in the postoperative period ^{26,31} Perioperative administration of corticosteroids ^{19,31}	Decreased age ³⁴ Anemia ³⁴ Respiratory diseases ³⁴ Altered body mass index or < 23 ³⁵ Prone position ²⁵ General anesthesia ²⁵ Intraoperative transfusion of blood products ²³ Sheet Cushion ²⁵ Low score on the Braden scale in the preoperative period ³⁴

RESULTS

In the present review, 19 articles were analyzed. The articles were published between 1998 and 2019, with the majority (57.9%) of the studies published between 2014 and 2019. It is noteworthy that only three (15.8%) studies were carried out in Brazil, while the others were carried out in China (n = 3; 15.8%), in the United States (n = 3; 15.8%), in Australia (n = 2; 10.5%), among other countries. The most common types of study were prospective (47.4%) and retrospective (31.6%). The surgical specialties that appeared the most were cardiovascular (26.3%), followed by gastrointestinal (15.8%), neurological (15.8%) and orthopedic (15.8%). As for the levels of evidence, a predominance of studies classified as LE 2 was identified (n = 15; 68.2%). These characteristics are presented in Chart 3¹⁷⁻³⁵.

The intrinsic factors associated with the development of PI most mentioned in the included studies were: advanced age (26.3%); female gender (15.8%); and *diabetes mellitus* (10.5%).

The most mentioned extrinsic factor associated with the development of PI was the surgical time (31.6%). Regarding the type of surgery mentioned in the included studies, cardiovascular

surgeries were mentioned in 42.1%, orthopedic in 31.6%, neurological in 26.3%, gastrointestinal in 21%, among others.

In studies in which individuals underwent cardiovascular surgery, the most common factor associated with the development of PI was the duration of surgery (n = 3; 37.5%). In orthopedic surgeries, the duration of surgery (n = 2; 33.3%) and advanced age (n = 2; 33.3%) were the most common factors associated with the development of PI. In neurological surgeries, the duration of surgery (n = 3; 60%) and the presence of *diabetes mellitus* (n = 2; 40%) were the associated factors that most contributed to the development of PI. Furthermore, studies that submitted individuals to gastrointestinal surgeries brought the duration of surgery (n = 3; 75%) and surgical positioning (n = 2; 50%) as factors associated with the development of PI.

DISCUSSION

Several factors were found to be associated with the development of PI in the perioperative period in individuals undergoing

Chart 3. Characterization of the studies included in the literature review. Virtual Health Library, 2021.

Cod*	Reference	Year of study	Country of study	Type of study	LE†
A1	Chen et al. ¹⁷	2015-2016	China	Retrospective analysis of medical records	2
A2	Yoshimura et al. ¹⁸	2014	Japan	Prospective observational study	2
A3	Chen et al. ¹⁹	2012	China	Longitudinal retrospective study	2
A4	Hayes et al. ²⁰	2010-2013	United States	Matched control case	2
A5	Webster et al. ²¹	2013	Australia	Prospective cohort	2
A6	Wright et al. ²²	2010-2012	Australia	Cohort	2
A7	O'Brien et al. ²³	2008-2009	United States	Cross-sectional retrospective study	4
A8	Bulfone et al. ²⁴	2009	Italy	Longitudinal study	2
A9	Scarlatti et al. ²⁵	2007	Brazil	Case series	4
A10	Primiano et al. ²⁶	2009-2010	United States	Prospective cross-sectional study	4
A11	Ginés et al. ²⁷	2004	Spain	Prospective longitudinal study	2
A12	Edwards et al. ²⁸	2004	United Kingdom	Retrospective longitudinal study	2
A13	Lindgren et al. ²⁹	1996-1998	Sweden	Prospective comparative study	2
A14	Schoonhoven et al. ³⁰	1998	Netherlands	Prospective follow-up study	2
A15	Stordeur et al. ³¹	1995	Belgium	Longitudinal study with prospective evaluation of patients	2
A16	Oliveira et al. ³²	2017	Brazil	Analytical longitudinal study	2
A17	Xiong et al. ³³	2016-2017	China	Longitudinal retrospective study	2
A18	Aloweni et al. ³⁴	2015-2016	Singapore	Retrospective analysis of cross-sectional medical records	4
A19	Peixoto et al. ³⁵	2017	Brazil	Longitudinal, prospective study	2

*Cod: encoding; †LE: level of evidence; E: Etiology. 1. Synthesis of cohort or case-control studies; 2. Cohort study or case control; 3. Metasynthesis of qualitative or descriptive studies; 4. Qualitative or descriptive study; 5. Expert opinion¹⁴.

elective surgery. The evidence found refers to intrinsic factors and to several extrinsic ones. The factors associated with the development of PI that appeared the most in the included studies were: advanced age, female gender, *diabetes mellitus*, and time of surgery.

The studies included were classified as LE 2 to 4, with the majority ($n = 15$; 78.9%) of the studies classified as LE 2 (cohort or case control studies)¹⁴. This finding indicates that the theme is widely explored in the literature; however, studies were performed with a variety of surgical specialties, making it complex to generalize these findings to all elective surgeries.

Advanced age is associated with the development of PI due to the very physiology of human aging, which causes a decrease in skin thickness, reduction of subcutaneous adipose tissue in the limbs, reduction of dermal capillaries, among other factors³⁶. In relation to females, the development of lesions may occur due to the large amount of adipose tissue present in women, which leads to increased pressure exerted on the tissues and exposure to hypoxia, as reported by Ribeiro in his review³⁷.

It is noteworthy that the international guidelines for the prevention and treatment of PI recommend performing a risk assessment using a risk assessment tool, added to the assessment of additional risk factors¹⁰. The use of scales that help in the detection of the risk of developing a lesion collaborates for the prevention of PI, such as the Risk Assessment Scale for the Development of Injuries Resulting from the Surgical Position of the Patient (*Escala de Avaliação de Risco para o Desenvolvimento de Lesões Decorrentes do Posicionamento Cirúrgico do Paciente – ELPO*), which is used as a parameter to detect the risk of surgical patients developing pressure injuries, the type of surgical position, time of surgery, type of anesthesia, support surface, limb position, comorbidities, and age of the patient³⁸.

Patients with *diabetes mellitus* are considered a population at risk for the development of PI, as they may have vascular compromise, with consequent changes in perfusion, in addition to peripheral neuropathy, which can reduce tissue tolerance to pressure¹⁰.

Regarding the prolonged duration of surgery, despite several studies^{20,22,25,30} identifying this as a risk factor for the development of PI, there is no consensus among authors about the time limit. It is noteworthy that the longer the surgical time, in which the patient is immobilized in the same position, the greater the risk of developing these lesions¹⁰.

Based on the findings of this study, it is recommended that health professionals, especially nurses, include the assessment of the estimated time of surgery and the presence of *diabetes* in the risk assessment of PI in patients undergoing elective surgeries. Despite being a topic widely explored in the literature, there is still a lack of studies that define, for example, surgery time limit for the development of PI. This study has as limitations the search in a single virtual library.

CONCLUSION

Several factors associated with the development of PI in the perioperative period in individuals undergoing elective surgery were identified, among which *diabetes mellitus* and prolonged surgery time stand out. Therefore, it is possible to conclude that the results of this study contribute to the advancement of surgical nursing, aiming, mainly, at the prevention of PI in the perioperative period.

FUNDING

None.

CONFLICT OF INTERESTS

The author declare there is no conflict of interests.

AUTHORS' CONTRIBUTION

KPPS: Project administration, Formal analysis, Conceptualization, Data curation, Investigation, Methodology, Resources, Writing — original draft, Writing — review & editing, Supervision, Validation, Visualization. SBSL: Project administration, Validação, Visualização. TDE: Project administration, Formal analysis, Conceptualization, Methodology, Resources, Writing — original draft, Writing — review & editing, Supervision, Validation, Visualization. LBTDS: Supervision, Validation, Visualization. RSAS: Supervision, Validation, Visualization. BRP: Data curation, Investigation, Writing — review & editing.

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| ERRATUM |

<https://doi.org/10.5327/Z1414-4425202227779erratum>

In the manuscript “Factors associated with the development of pressure injuries in elective surgery: integrative review”, DOI: 10.5327/Z1414-4425202227779, published in the Rev SOBECC, 2022;27:E2227779:

Where it reads:

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